Cover Sheet

Name of Workshop		**ICS 2002 Workshop on Multimedia Technology**		
Title of the Paper		A Method for Composing Remote Interactive Broadcasting System		
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Authors	Name	Jong Myeon Jeong	Jin Soo Choi	Jin Woong Kim
	Affiliation	Broadcasting Media Research Department, Electronics and Telecommunications Research Institute (ETRI)		
	Postal Address	161 Gajeong-Dong, Yuseong-Gu, Daejeon, 305-350, Republic of KOREA		
	E-Mail Address	jmjeong@etri.re.kr	jschoi@etri.re.kr	jwkim@etri.re.kr
	Telephone Number	+82-42-860-1611	+82-42-860-5185	+82-42-860-6260
	Fax Number	+82-42-860-5479		
Name of the Contact Author		Jong Myeon Jeong		
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A METHOD FOR COMPOSING REMOTE INTERACTIVE BROADCASTING SYSTEM

Jong Myeon Jeong, Jin Soo Choi, and Jin Woong Kim

Broadcasting Media Research Department,
Electronics and Telecommunications Research Institute(ETRI), Daejeon, Republic of Korea
{jmjeong, jschoi, jwkim}@etri.re.kr

ABSTRACT

We propose a method for composing remote interactive system (so-called return channel server: RCS) to provide user participation program via bi-directional return channel. In our method, RCS consists of two parts, which are RCSA (return channel server application) and RCSAE (return channel server application environment).
RCSA define procedures of RCS to provide specific broadcasting program and RCSAE provide various functions to support execution of RCSA.
By using RCSA and RCSAE, we can construct RCS which has service-independent architecture.

1. INTRODUCTION

With the advent of digital broadcast, the interactive broadcast has attracted considerable attention.
The interactive service can be classified by the local interactive service and the remote interactive service.
In the local interactive service, broadcast service provider transmits the additional data to receiver and user can interact with the receiver using the additional data that stored in local storage of the receiver. There are many examples on local interactive services. EPG(Electronic Program Guide) service is the representative example of the local interactive service[1].
In the remote interactive service, on the other hand, broadcast service provider transmit the additional data to receivers and user can access internet to get further information which related to additional data and/or not. Furthermore, user can participate the broadcasting program by interacting with the remote server.
Most previous works for the remote interactive service are concerned with interaction network[2], and there are little results for the organization of RCS(Return Channel Server). In the [3], Ko proposed the architecture of return channel server for supporting user participation broadcasting program, but it has a service-dependent architecture that support specific broadcasting scenario only.
In this paper, we propose a new method for composing remote interactive system (so-called return channel server) to supports user-participation program. The proposed method provides the generic system architecture for composing RCS that has service-independent architecture.

2. TERMINOLOGY

In this section, we would like to explain terminologies frequently used in this paper.
First of all, the return channel is the bi-directional interaction channel between the Interactive Service Provider (ISP) and receivers.
RCS is the remote server existing in ISP side. It receives the user's data from receivers by using return channel, and performs the behavior to reflect and to process the user's request or opinion. A wide sense of RCS includes the hardware, RCSAE (Return Channel Server Application Environment), and RCSA (Return Channel Server Application). On the other hand, a narrow sense of RCS means RCSAE itself.

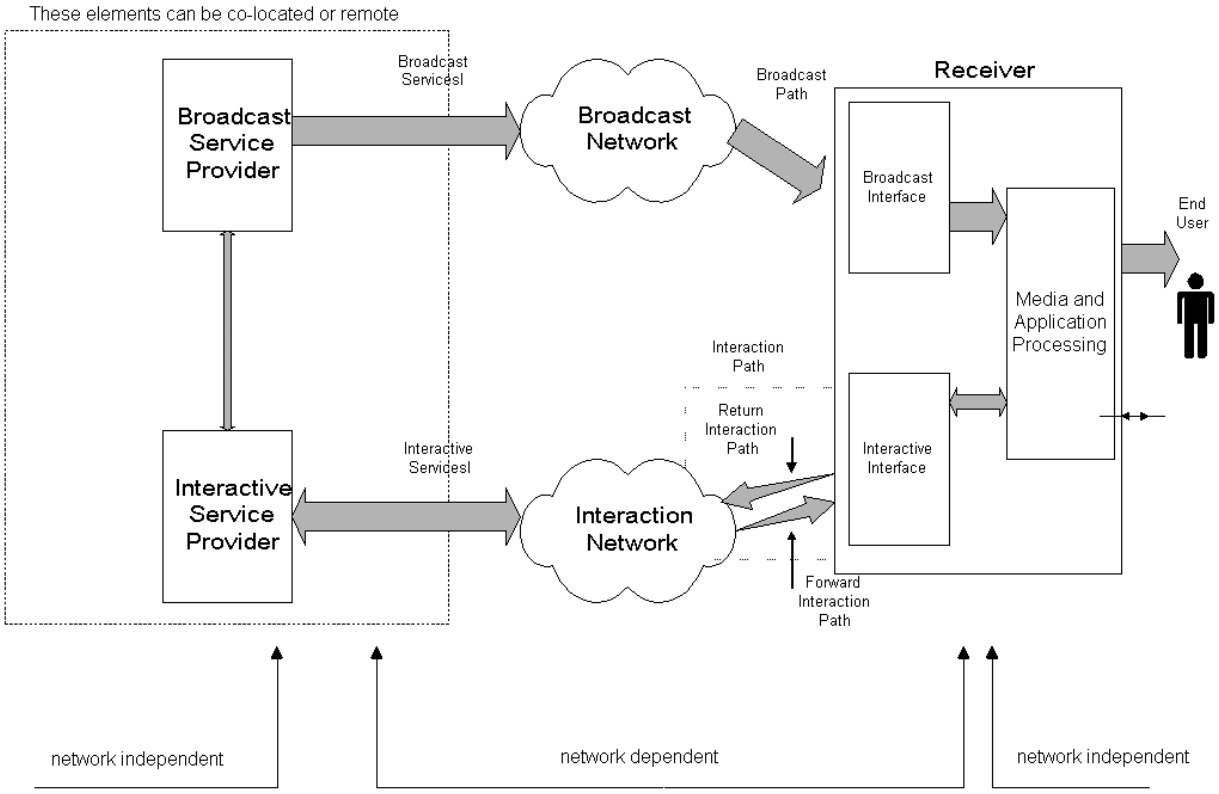

Figure 1 Architectural model for interactive services.

RCSAE is the general term for the operating system, device driver, middleware, and generic functions, which are required to support execution of RCSAs.
Finally, RSCA is an execution code which define procedures of RCS to provide specific broadcasting program.
It is noted that the RSCAE provide service independent platform for RCSA, and RCSA defines service dependent procedures for the specific broadcasting program.

3. PROPOSED METHODS

3.1. System Overview

In this paper, we propose an interactive data broadcasting system based on architectural model for interactive service of ATSC and DVB[4]-[5]. As figure 2 illustrates, the proposed system consist of Broadcasting Emission Station and RCS, where the Broadcasting Emission Station correspond to the Broadcast Service Provider and RCS correspond to the Interactive Service Provider.

The Broadcasting Emission Station can be viewed as consisting of three major functional modules. They are Multiplex Manager, Content Database Module, and Emission Module.
The role of Multiplex Manager is to communicate required information to any module needing it. It assumes the function of control and automation, scheduling and return channel management.
The role of Content Database Module is to store and management all the required contents for the data broadcasting. It provides contents to the Emission Module and RCS by complying with the Multiplex Manager's control.
The Emission Module accepts as input video, audio and additional contents and combines these data into the single MPEG-2 Program, adding the appropriate clock references and timestamps. The output of the Emission Module is used for the input of the Transmission System.
The structure and functionality of RCS will be described in section 3.2.

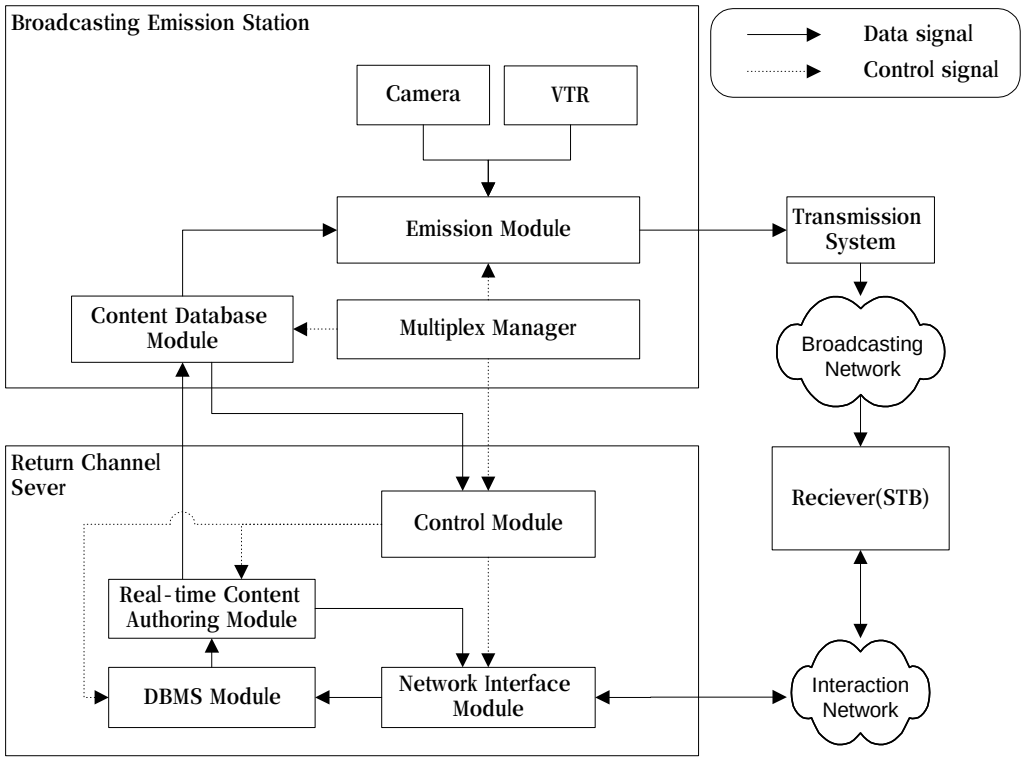

Figure 2 System overview.

3.2. Structure and Functionality of RCS

To provide user participation program which reflects user's opinion or responses, the desirable functions of RCS include functions for the receiving user's data via the return channel, for the storing and managing of user's data by using DBMS (DataBase Management System), to produce contents which reflect user's data stored in DBMS, and for providing content which reflect user's data to the receivers by using broadcasting network and/or IP network.

To support above functions, RCS can be viewed as consisting of four major functional modules: Control Module, Network Interface Module, DBMS Module, and Real-time Content Authoring Module which are illustrated in figure 2.

The role of Control Module is to assume the function of control and automation.

The control signal from the Multiplex Manager and parameters of RCSA from the Content Database Module are used for operating of Control Module.

The role of Network Interface Module is to receive user's data via interaction network.

The role of DBMS Module is to store and manage the user's data.

Finally, the role of Real-time Content Authoring Module is to produce contents which reflect user's data, and to send it to the Broadcasting Emission Station and/or Network interface Module for transmitting it to receivers through broadcasting network or IP network.

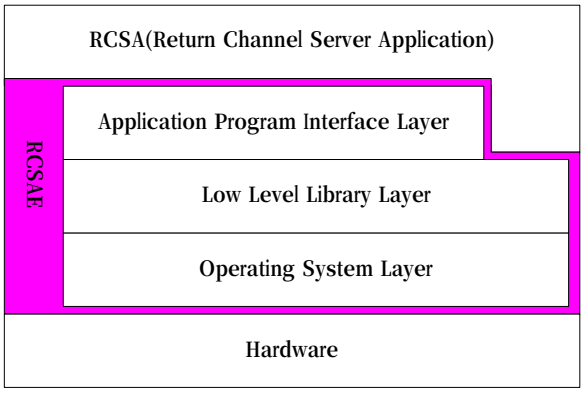

Figure 3 Hierarchical structures of RCS.

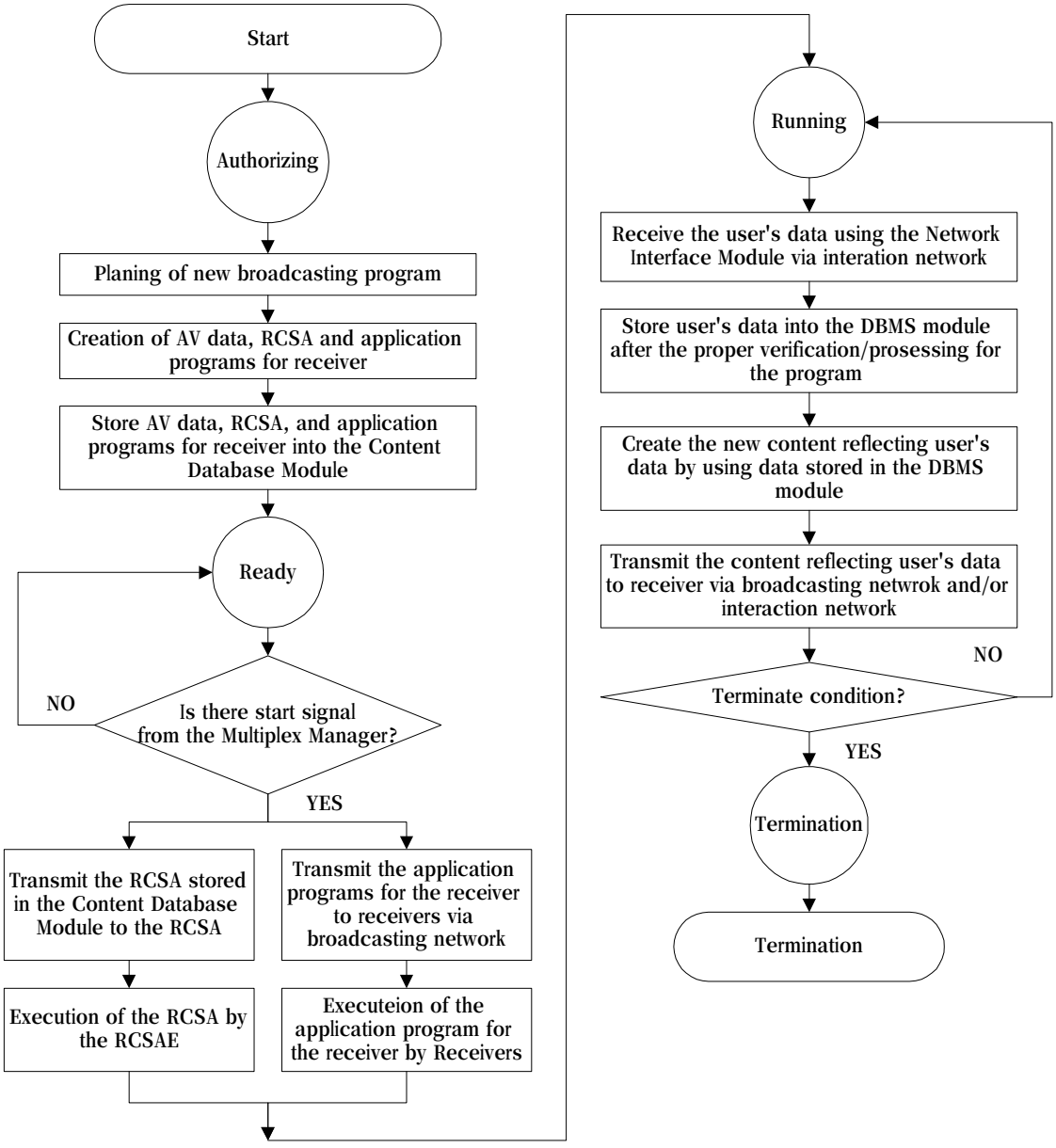

Figure 4 Acting scenario for the proposed interactive broadcasting system.

3.3. Hierarchical Structures of RCS

In this paper, we propose a new method to provide the generic system architecture for constructing RCS that has service-independent platform.

In our method, RCS consists of two parts: RCSAE and RCSA. Figure 3 shows the hierarchical structures of RCS.

RCSA of figure 3 is the execution code which define procedures of RCS to provide specific broadcasting program, and it cooperates with the application program running on the receiver(STB).

Naturally RCSA become changeable variously depend on the broadcasting producer's intention, and the broadcasting producer should produce both of RCSA and the application program for receiver,

when he produce new interactive broadcasting program.
RCSAE supply the software environment for the execution of RCSAs. As shown in figure3, RCSAE consist of three layers: Operating System Layer, Low Level Library Layer, and Application Program Interface Layer.
The Operating System Layer consists of operating system, device drivers, network drivers and so on. It supplies functions for management of hardware.
The Low Level Library Layer supplies low level libraries based on the Java virtual machine and/or C language.
Finally, the Application Program Interface Layer exists on the Low Level Library Layer. The Application Program Interface Layer is a kind of packages consists of low-level libraries for the providing running environment for RCSA.
By using the hierarchical structure of RCS, we can construct RCS with service-independent fashion.

3.4. Acting Scenario of Interactive Broadcasting

Interactive broadcasting system described above section operates through the procedures presented in figure 4.
As figure 4 illustrates, the proposed acting scenario consists of four steps which are Authorizing, Ready, Running, and Termination.
In the Authorizing step, the interactive broadcasting provider plan a new interactive program and create a new program. An interactive broadcasting program consists of AV data, RCSA, the application program for the receiver and so on. These contents are stored in the Content Database Module for the broadcasting.
The Ready step is started, when RCS receive a start signal from the Multiplex Manager.
In the Ready step, the Broadcasting Emission Station transmits RCSA and the application program for the receiver to RCS and receivers, respectively. Then RCS and receivers execute RCSA and the application program for the receiver in accordance with conditions for the execution.
In the Running step, RCS collects user's data via interaction channel, stores it into the DBMS module after proper verification/processing for the specific program, creates the new content reflecting user's data, and transmits the new content to the receiver via broadcasting network and/or interaction network.
Above procedure is repeated until the termination condition from the Broadcasting Emission Station is satisfied.
When the termination condition is satisfied, the action of RCS for the interactive broadcasting is terminated.

4. SUMMARY

In this paper, we presented a new method for composing RCS to provide user participation program via bi-directional interaction network.
In our method, RCS consists of two major parts which are RCSA and RCSAE.
RCSA is the execution code which defines the procedure of the specific broadcasting program to reflects broadcasting producer's intention. RCSAE, on the other hand, supplies the software environment for the execution of RCSAs.
The proposed method provides generic system architecture of RCS having service-independent platform by adopting hierarchical structures due to RCSAE and RCSA.

5. REFERENCES

[1] J. B. Tommy, "Automatic EPG Generation for Broadband IP Network," International Conference on Broadcast Asia 2001, pp. 73-77, 2001.

[2] P. Clement, "A Country Scale Interactive Television Architecture," International Conference on Broadcast Asia 2002, vol. 1 of 2, 2002.

[3] J.B Ko, "An Apparatus and Method for the Interactive Broadcasting Service for the Massive Users," Republic of Korea Patent no. 10-2000-0084124.

[4] ATSC T3/S16 Document, "ATSC Interactive Services Protocols for Terrestrial Broadcast and Cable" Draft 0.70b, 2000.

[5] ETSI ETS 300 802, "Digital Video Broadcasting(DVB);Network-independent Protocols for DVB Interactive Services," November, 1997.